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The Effect of Prone Position on Gastric Residuals in Preterm Infants

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Authors' contributions

This work was carried out in collaboration between all authors. Author GFA designed the study. Authors SR and FG managed the analyses of the study and managed the literature researches, Author HB wrote the first draft of the manuscript and wrote the protocol. Author BPA performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Background: Gastric residual is a common problem in preterm infants. Position after feeding affects the gastric residuals in preterm infants. This study aims to determine the effect of changing the infant's position on gastric residuals.
Method: This study was conducted a cross-over study in a level III neonatal intensive care unit. Gavage of the neonates was conducted in two stages. The first stage was conducted with a volume feeding of 50 cc per kg every day of milk and the second stage was done with a volume feeding of 100 cc per kg every day. After feeding, infants were placed in the desired position (prone) for 180 minutes and the gastric residuals were measured and recorded. Half of the neonates considered as control group. Data were analyzed by independent-samples paired t-test, Mc Namara's test, and

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Fisher and Pearson test.
Results: This study's findings indicated that residuals in preterm infants after 180 min in the prone position was less than residuals in infants after 180 min in the control group – this result is the same for both volume 50 cc/kg/day and 100 cc/kg/day (P=0.0001).
Conclusion: Considering there's less gastric residual in a prone position, placement of infants after feeding and then changing the position according to the behavior cues of them is recommended. These results could help health care professionals to provide efficient feeding, as well as perform the appropriate positioning of preterm infants.

Keywords: Positioning; gastric residual; preterm infant; Prone.

1. INTRODUCTION

Since most infants admitted to the neonatal intensive care unit, were born prematurely, the main argument about high-risk neonates is premature infants. Considering that 7-19 % of births occur when the baby is under 37 weeks old, preterm birth is one of the main challenges in the neonatal field. Premature infants experience numerous problems including difficulty breathing and apnea attacks, the inability to effectively regulate body temperature and other complications arising from the lack of developmentally appropriate body systems [1].

In order to improve respiratory function, care should be taken to supply essential nutritional needs during infant feeding ensuring they are fed by methods that do not lead to aspiration, regurgitation or fatigue [2]. Early enteral feeding is necessary for the gastrointestinal track in premature babies. Preterm infants who receive early enteral feeding tolerate full oral feeding better than others, preventing many long-term complications of parenteral nutrition. Thus, many neonatal intensive care units try to start neonatal enteral feeding as soon as possible and prefer breast milk [3].

Feeding intolerance in preterm infants is common. Gastric residuals, abdominal distention and emesis are regarded as indexes of feeding intolerance [4]. Gastric residuals are more common in neonate babies. Clinically speaking, gastric residuals act as a criterion for determination of increasing volume, postponing of feeding or temporarily stopping feeding [5]. Over the last decade, medication to treat gastric problems such as feeding intolerance is increased in preterm infants [6]. It is important for neonatal care givers to focus on progress in premature infants' health. Recently, the important emphasis has been placed on supportive strategies for developmental health. These strategies are crucial nursing practices for neonates and one of them is change body positioning. Use of supplementary treatment is for fewer drugs use and then fewer side effects and costs [7].

Body position is a factor that affects gastric residuals. Position after feeding can help to prevent maximum gastric residuals volume [8]. In preterm infants, those that are breast milk-fed have less gastric residual. However, using formula and breast milk simultaneously rather than providing preterm infants with the same feeding regimen may cloud the interpretation of results [9].

Anuntaseree et al. reported that the supine position is more common in the West than in Asia [10] and there are no differences between infants fed by formula or breast milk [9]. Also, previous studies found that infants in the prone position had better tolerance [11,9and12]. Until now, very few studies have examined the effect of body position on gastric residual in preterm infants. In an Iranian context, no research was found to examine body position on gastric residual. This study was conducted to assess the effect of body position on gastric residual in preterm infants who hospitalized in the NICU in the south-east of Iran.

2. METHODS AND MATERIALS

This is a cross-over study in a level III neonatal intensive care Unit, conducted in Kerman, Iran. The sample of infants in this study was selected from one hospital under the supervision of the Kerman University of Medical Science. Seventy-two infants who were admitted to neonatal intensive care participated in the study and divided into intervention and control group. They included male and females who were less than 37 weeks gestational age and reported an Apgar score of >7 at 5 min. The infants selected were without cardiac compression, were using a feeding tube, with 3 hours interval of feeding. We

excluded infants who had vomiting and bilious-stained gastric aspirate, other gastrointestinal disease and had chest tubes. Data collection was a check list that included two parts: demographic characteristics and the registration of measured variables. Demographic characteristics consist of gestational age, sex, birth weight, Apgar score at first and fifth minute and respiratory support. In the registration, we recorded body position, the volume of gavage milk and the volume of gastric residual after 180 min positioning. We recorded milk volume using a daily chart written by a physician. When the feeding volume received by an infant reached 50 cc per kg a day the infant would be enrolled in our study (stage 1). Body position was determined by dice. Even numbers signified the prone position and odd numbers signified control group and infant placed in the position that chosen by dice. After positioning the neonate and waiting 180 min, we recorded gastric residuals and observed whether the infant had moved positions. After 180 min gastric residuals were determined again. Gastric residuals were identified by syringe and recorded. Daily charts of infants who participated in this study and previous steps were done on them, controlled daily and when feeding volume received to100 cc/kg/day, infant enrolled to the study again (stage 2). At first, we asked mothers to express the breast milk and keep it in a clean container (2-8^{o}C). If there is no possibility of the mother's breast milk, or the volume of breast milk was low, a formula specific for premature infants was used. To unify conditions for all babies, the study was performed at night and using feeding tube (NGT or OGT) for all of them. If a baby was fed breast milk in stage 1, he/she was fed by breast milk in stage 2 and vice versa. There was an approval from the heads of NICU prior to the collection of data. The study proposal also was reviewed and approved by the Centre's Office of Research Ethics in Kerman at the Medical Science University (Ethic code: IR.KMU.REC.1394, 123). Informed consent forms were signed by parents. The consent form explained that participation was completely voluntary, and they can withdraw from the study at any time. They were informed about the purpose of study and procedure. To secure confidentiality there was no personal information on the scale. Data were analyzed using SPSS22. Descriptive statistics were used to determine to mean, Standard Deviation, frequency, and percent of categorical variables. The hypothesis was tested with pair t-test, McNamara, Fisher and Pearson correlation coefficient.

3. RESULTS

A descriptive analysis of the background information indicated that the premature infants belonged to the gestational age of fewer than 37 weeks and they were mostly males in both groups (Table 1).

Statistical analyses showed a significant difference between body position and gastric residuals. The gastric residual were significantly lower in the prone position at stage 1 and 2 (P=0.0001). The decrease in percentage in the control group was from 100% to 76.74% at stage1 and 71.54% at stage 2, while in the prone position, the decrease in percentage was from 100% to 56.05% at stage1 and 51.93% at stage2. (Table2). There were not observed a significant difference between Gastric residual and type of milk and other demographic characteristics.

Table 1. Characteristics of the study sample (n=72)

Characteristics	N (%) or mean(SD) Intervention group N=36	N (%) or mean(SD) control group N=36
Sex		
Male	20(52.8)	22(62.2)
Female	16(47.2)	14(32.8)
Delivery type		
NVD[1]	9(23.6)	13(36)
C/S[2]	27(76.4)	23(64)
Gestational age(week)	32.31(2.16)	32.96(2.18)
Birth weight(gram)	1850.28(315.98)	1970.44(315.98)
Apgar score(5min)	9(0.98)	9(0.98)

[1]*Normal Vaginal Delivery*
[2]*Cesarean Section*

Table 2. Gastric residuals in the intervention and control groups at feeding volumes

Time(min)	Control		Prone		t	P
	M%	SD%	M%	SD%		
Stage 1	76.74	20.16	56.05	21.14	5.3	0.0001
Stage2	71.54	18.65	51.93	15.95	6.2	0.0001

4. DISCUSSION

This study adopted a prospective, time series, cross-over design to trace the change in gastric residuals over time when preterm infants were posed in the prone position. The results of this study contribute to a better understanding of the relationships between time, position and gastric residuals; they could also help health care professionals to provide efficient feeding as well as perform appropriate positioning of preterm infants. Such results cannot be found by either one- or two shot measurement. In the current study, we clearly demonstrated that no matter what position the preterm infants were placed in, the period in which the gastric residuals decreased the fastest in preterm infants was the first half an hour post-feeding, and the rate of decrease was especially high in the prone position. Through an intensive systemic review, Picheansathian et al. [8] showed that prone positioning has many advantages for premature infants, such as improving arterial oxygen saturation [13], less apnea and hypoxia, and better thoracoabdominal synchrony [14] and body position change facilitates lung improvement of lung function in infants on ventilatory support [15]. Infants sleeping in the prone position also have higher surface temperatures and narrow central to peripheral temperature gradients [16].

There are also disadvantages to the prone position, such as an increase in postural abnormalities, a higher incidence of orthopaedic abnormalities of feet, and a delay in muscular development [8,17]. Studies have also shown the prone sleeping position to be strongly associated with sudden infant death syndrome (SIDS) [18]. It has been reported that positioning plays an important role when providing developmental care to preterm infants whose neuromotor system is immature [8]. Evidence supports that developmental care has a positive effect on preterm infants in the neonatal intensive care unit [19,20]. Appropriate positioning, such as turning when feeding also contributes to the stability of preterm infants' neuromotor system and promotes self-regulation [8]. Health care professionals should understand the importance of timing in changing the position of preterm infants in order to optimize their physiological development. Consequently, placement in the prone position for the first half an hour of post-feeding and then changing position according to the behavior cues of infants is suggested. Behavioural cues are the categorized as autonomic, motor, and state behaviours [21]. Nurses should support preterm infants' self-regulatory activities based on their behavioural cues to adjust to a proper position. This suggestion also coincides with the principle of individualized developmental care for low birth weight preterm infants [20].

Some studies have shown that the prone position could facilitate lower gastric residuals compared other positions [9,22] while some studies have reported no significant effects of posture on the pattern of stomach emptying. The inconclusive results may be due to the different methods used in previous studies. Different methods have been used to measure gastric residuals such as using the dilation technique, which is invasive [23]. In the current study, we measured the gastric residue volume, which is non-invasive, and easily observed and compared under natural feeding conditions. In the triple cross-over study of Cohen et al. [24] thirty-one preterm infants were studied and the gastric residuals were measured at 1 and 3 h after the initiation of feeding. Similar to our results; Cohen's study showed the volume of residuals 1 h after a feed was lower in the order of right, prone, supine and left positions [24]. However, contrary to our findings, they did not find any significant differences between the four positions in the terms of the volume of gastric residuals 3 h after feeding. The inconsistent finding may be due to the fact that all of the measurements of the infants were taken during the night shift in order to lower the influence of medication in the current study which had a much larger sample size.

In general, what constitutes clinically significant gastric residual remains unclear; controversy also exists regarding the role of gastric residuals. Observing fifty preterm infants prospectively, Shulman et al. [5] found no correlation between the gastric residue volume threshold and the

feeding outcomes. However, they also indicated that a delay in attaining full feeding might be a result of various factors acting at the same time and suggested that continuous randomized study is needed to determine whether different GRV management protocols can be used to direct feeding management [5]. Several authors have argued that the occurrence of GRV may be more an indicator of gut immaturity rather than gut dysfunction [25]. Nevertheless, in clinical practice, gastric residue, combined with other signs is an important indication of whether to increase or withhold the feeding volume, especially for high-risk infants [26]. Therefore, clarifying the relationship between GRV and position is also helpful in order to understand the health status of preterm infants and provide them with a proper feeding strategy.

5. CONCLUSION

Preterm infants have lower gastric residuals in the prone position at both feeding volumes. It is suggested that preterm infants are posed in the prone position at first after feeding and their position is subsequently changed according to their behaviour cues. The result of this study contribute to a better understanding of the relationship between position and gastric residuals; this simple positional intervention could also help health care professionals to provide efficient feeding as well as perform appropriate positioning of preterm infants. Nurses working in NICU need to be educated on how body position affects gastric residual of preterm infants. All information on the risks and benefits as well as the best intervention strategies before this intervention is conducted should be included in the educational program. Further study suggests examining NICU nurses' views on this intervention, its benefits and disadvantages as well.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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